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Labbe et al.

[11] **3,813,996**

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[54] **CONTINUOUS FILTER ROD MAKING MACHINES**

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[21] Appl. No.: **243,964**

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[52] **U.S. Cl.** ..... **93/1 C,** 93/77 FT

[51] **Int. Cl.** **A24c 5/50**

[58] **Field of Search** ..... 93/1 C, 77 FT

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Primary Examiner—Roy Lake
Assistant Examiner—James F. Coan
Attorney, Agent, or Firm—Markva & Smith

[57] **ABSTRACT**

A continuous cigarette filter rod making machine in which a tow or web of crimped filaments is fed on to a continuous paper web and is wrapped to form a filter rod. In one construction a compression wheel is provided between upstream and downstream parts of a tongue. In a second construction the upstream part of the tongue is replaced by a channel cooperating with the wheel. In a third construction the tow passes between two suction wheels, and in the fourth construction the compression means is a suction band passing around two wheels upstream of the tongue.

15 Claims, 20 Drawing Figures

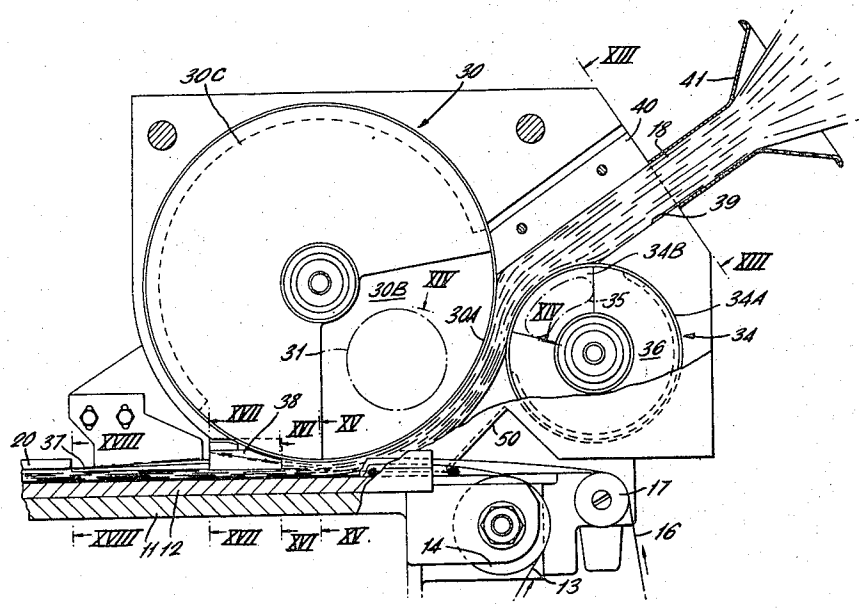

FIG. 1.

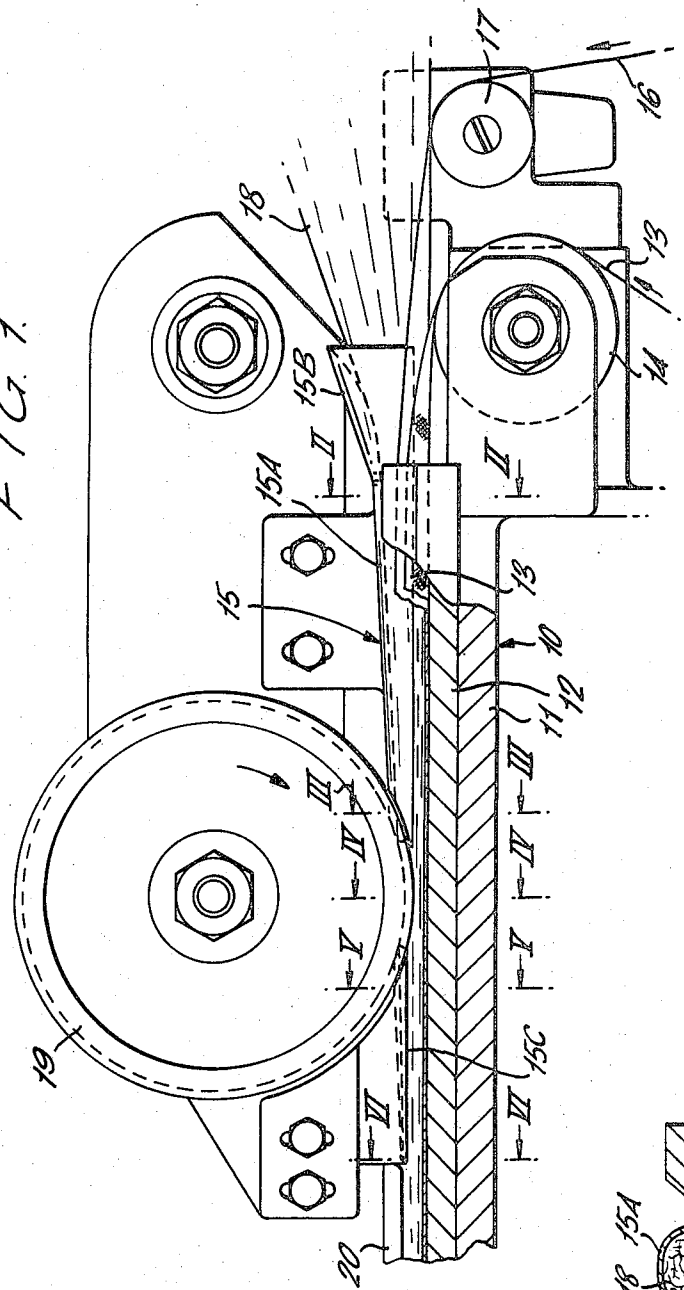
17
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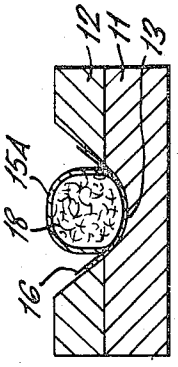
FIG. 2.


12
11
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15A
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16

FIG. 3.

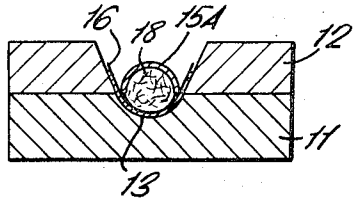


FIG. 4.

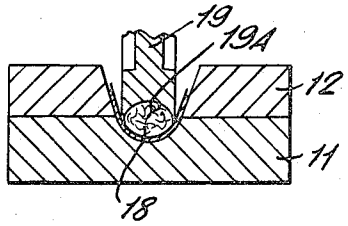


FIG. 5.

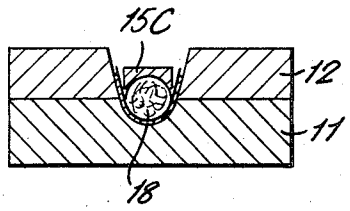


FIG. 6.

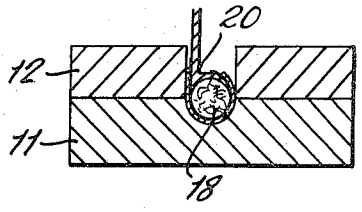


FIG. 8.

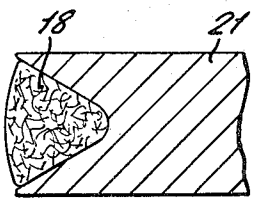


FIG. 9.

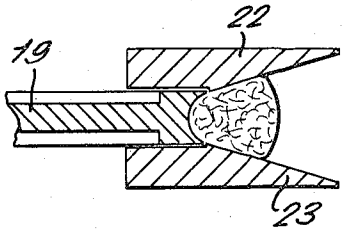


FIG. 10.

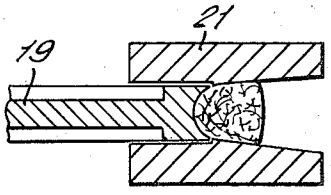
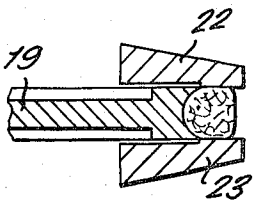


FIG. 11.



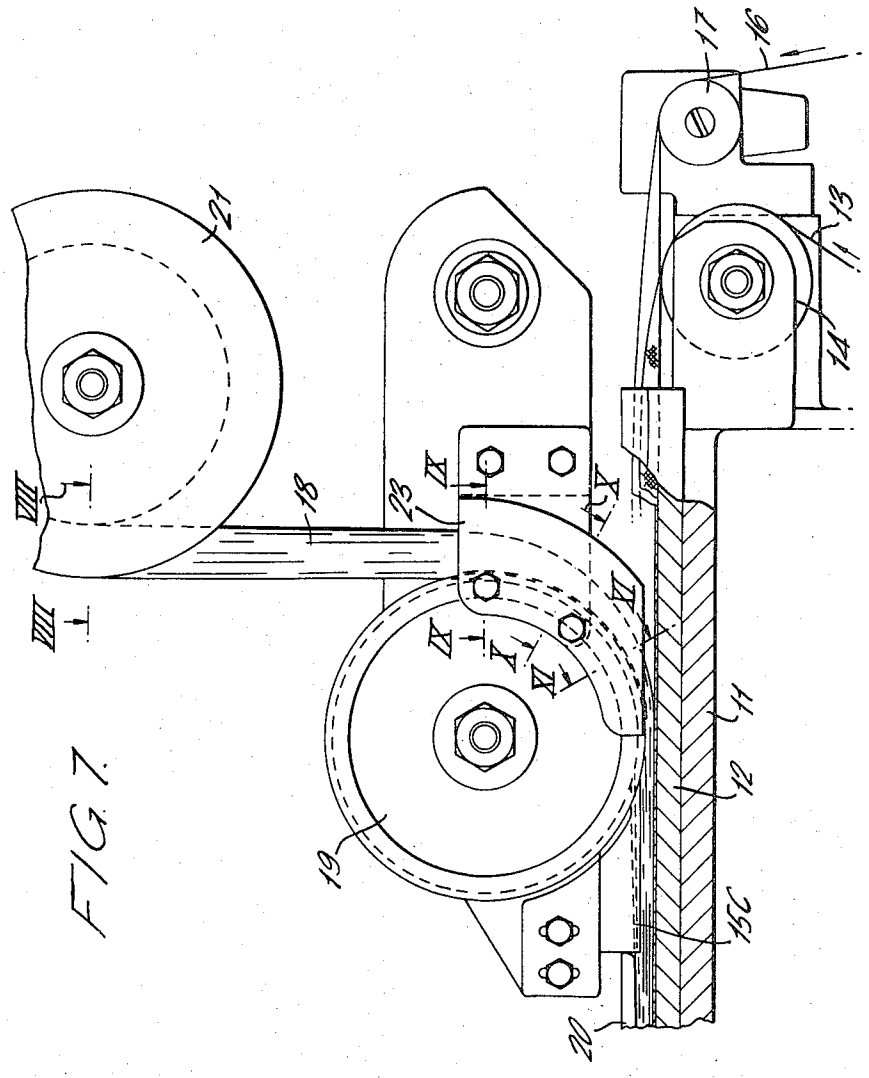
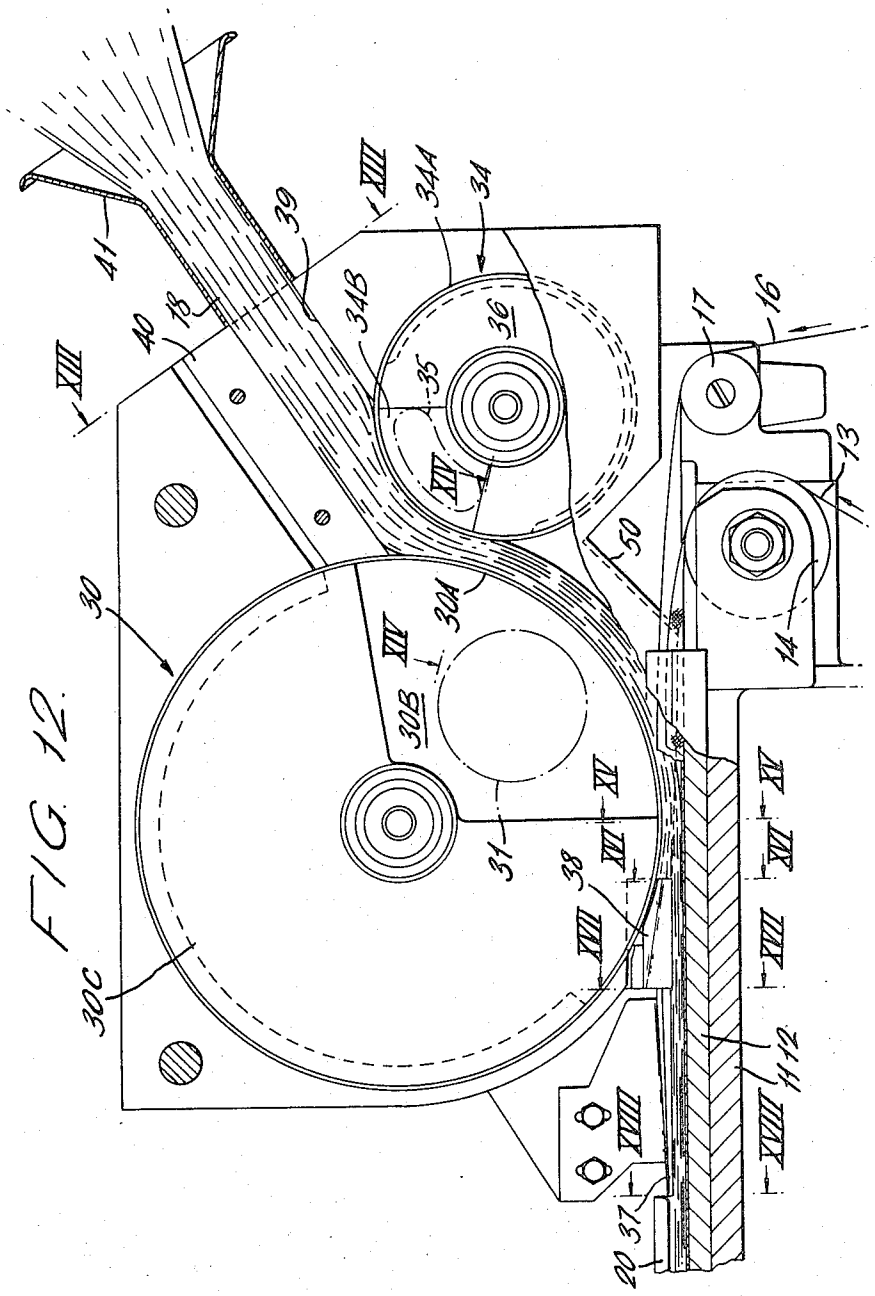


FIG. 7.


41
39
XIII
34A
34
40
18
34B
36
35
17
16
XIII
XIII
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11
50
30
30A
14
XIV
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30C
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XVIII
37
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FIG. 12.

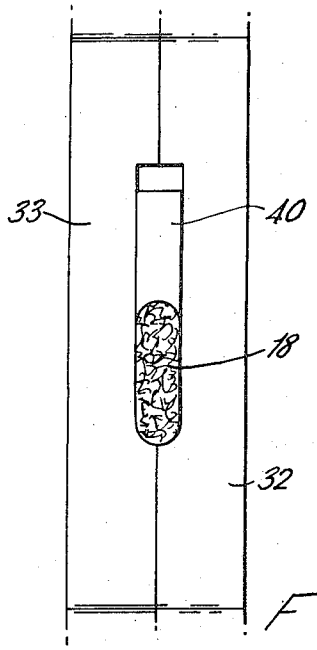


FIG. 13.

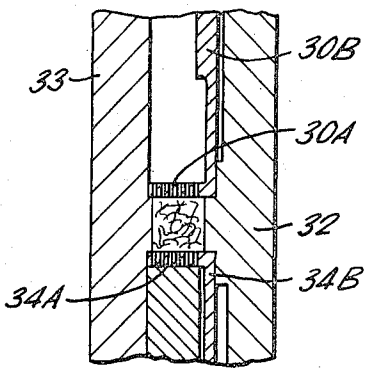


FIG. 14.

FIG. 15.

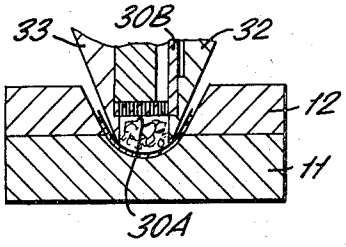


FIG. 16.

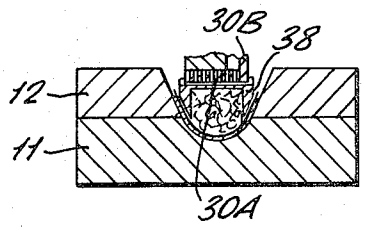


FIG. 17.

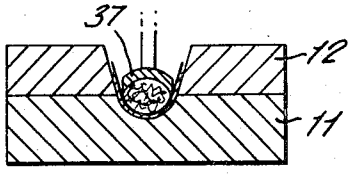
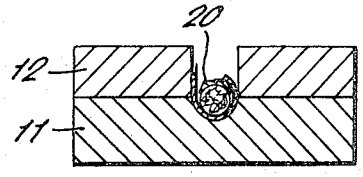


FIG. 18.



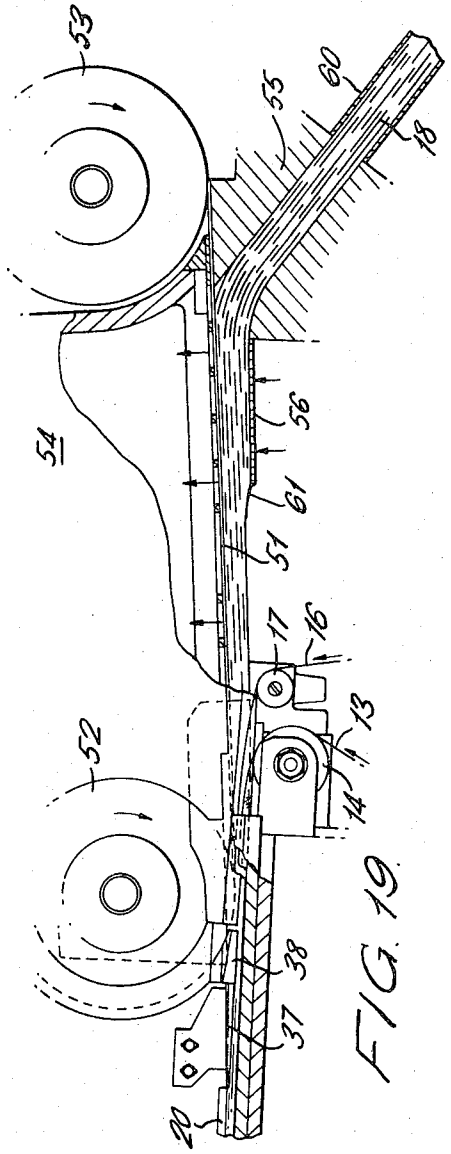


FIG. 19.

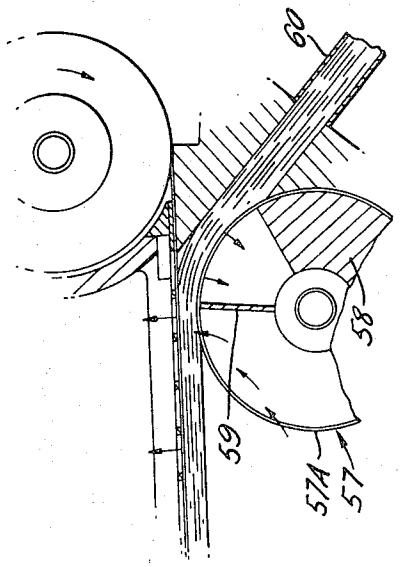


FIG. 20.

CONTINUOUS FILTER ROD MAKING MACHINES

This invention relates to continuous cigarette filter rod making machines.

In such machines filter material in the form of a web or tow consisting of a bundle of crimped filaments of material such as cellulose acetate is fed on to a continuous wrapper which is carried through a garniture by means of a garniture tape. In the garniture the wrapper is folded around the filter material and has its edges overlapped and sealed together to form a continuous filter rod which is severed into lengths of filter rod of multiples of the length of a filter to be combined with cigarettes to form filter cigarettes.

Before being carried into the folding mechanism the tow passes through a tongue where it is laterally compressed. One of the limitations on the speed at which the continuous filter rod can be formed is the rate at which the tow can be passed through the tongue without the resistance to flow therethrough creating such tension in the tow as seriously to reduce the crimped nature of the filaments.

According to the present invention there is provided a continuous cigarette filter rod making machine in which a tow or web of crimped filaments is fed on to continuous paper wrapper web and is carried through a tongue by means of a garniture tape, the machine comprising a driven conveyor means between which and the paper wrapper the tow is compressed, the conveyor means being provided upstream of at least a downstream part of the tongue.

The conveyor means may be a compression wheel.

The tongue may comprise an upstream section and a downstream section and the conveyor means may be a wheel which is adjacent the downstream end of the upstream section and the upstream end of the downstream section so that the tow on leaving the upstream section immediately comes under the control of the wheel which maintains substantially the same amount of compression in the tow whilst assisting its movement through the tongue.

The peripheral speed of the compression wheel is at least as great as the speed of the garniture tape.

In place of the upstream section of the tongue there may be provided means cooperating with the compression wheel to form a channel into which the tow is supplied, the cross-sectional area of the channel decreasing in the direction of travel of the tow so that the tow is progressively compressed.

Suction may be applied to the compression wheel over an angular extent ending in the region of maximum compression between the compression wheel and the paper web, the tow being supplied to the compression wheel adjacent the point at which suction is first applied.

A further suction wheel may be provided adjacent the point at which the tow meets the compression wheel so that the tow is supplied into the bite formed between the two wheels, suction being applied to the further suction wheel over the angle for which the tow is in contact with the further wheel.

The tow may be supplied to the compression wheel through a trumpet, the cross sectional area of which tapers in the direction of travel of the tow.

The two wheels may rotate at a peripheral speed substantially equal to the speed of the garniture tape and

the tow may be supplied at a greater rate so that it concertinas.

The compression means may be an air pervious conveyor band which passes around two wheels, one of which immediately precedes the tongue, suction being applied to the run of the conveyor band upstream of the wheel which immediately precedes the tongue.

The tow may be supplied to the conveyor band at a greater rate than the speed of the band and may be supplied through a trumpet whose cross sectional area tapers in the direction of flow.

The tow may be applied to the band at an angle such that the ratio of the speed of the band to the speed of the tow approaching the band is substantially equal to the cosine of the angle at which the tow meets the band.

A suction wheel may be provided where the tow meets the band so that the tow is compressed between the wheel and the band.

Four embodiments of the present invention will now be described by way of example with reference of the accompanying drawings of which:-

FIG. 1 is a side elevation partly in section of part of a continuous filter rod making machine illustrating a first embodiment of the invention,

FIGS. 2 to 6 inclusive are sectional views on the lines II—II, III—III, IV—IV, V—V, VI—VI respectively of FIG. 1,

FIG. 7 is a side elevation partly in section of a second embodiment,

FIGS. 8 to 11 inclusive are sectional views on the lines VIII—VIII, IX—IX, X—X and XI—XI respectively of FIG. 7,

FIG. 12 is a side elevation partly in section of a third embodiment,

FIG. 13 is a view on the line XIII—XIII of FIG. 12,

FIGS. 14 to 18 inclusive are sectional views on the lines XIV—XIV, XV—XV, XVI—XVI, XVII—XVII and XVIII—XVIII respectively of FIG. 12,

FIG. 19 is a side elevation partly in section of a fourth embodiment, and

FIG. 20 is a modification of part of FIG. 19.

FIG. 1 shows part of a continuous rod machine for making cigarette filter rods. The filter material is in the form of a tow, i.e., a bundle of crimped continuous filaments or fibres which is compressed laterally and is wrapped in a continuous paper wrapper to form a continuous filter rod which is cut into lengths equal to a convenient multiple of the length of filter to be used in a filter cigarette. The material of the tow is commonly cellulose acetate. The tow is supplied from a tow processing unit which takes the tow from a bale and "opens" or "blooms" it i.e., separates each individual fibre from those adjacent to it.

The machine comprises a garniture bed on which a garniture tape passes through a tongue and then through folding and gumming devices. A continuous paper wrapper web is carried through these devices on the garniture tape and the tow is supplied to the paper web adjacent to the entry to the tongue. In the tongue the tow is initially compressed and shaped, compression and shaping to the circumferential size and shape desired in the rod being carried out by the folders. On leaving the tongue the paper web is folded about the tow, an edge of the paper web being gummed and the edges of the paper web sealed together to form a con-

tinuous paper tube containing the compressed tow. The continuous rod is then severed into short lengths by a cut off device.

In FIG. 1 the garniture bed is indicated generally at 10 and comprises a base plate 11 and lower folders 12. The garniture tape is shown at 13 and enters the bed at the right hand side and passes over a pulley 14 and through the tongue shown generally at 15. The continuous paper wrapper web is shown at 16 passing over a further pulley 17 and through the tongue 15 on top of the garniture tape 13. The tow entering the machine from the tow processing unit is shown at 18.

The tongue is normally of part conical shape and cooperates with the generally V-shaped groove formed by the folders 12 and base plate 11 to produce a passage whose cross sectional area diminishes progressively from its entry end to its exit. The tow is carried through the tongue by the friction between the tow and the paper web which in turn is carried by friction with the garniture tape. One of the limitations on the speed at which the filter rod can be made satisfactorily is the resistance to flow therethrough of the tow imposed by the tongue. Any slipping of the tow on the paper will result in under-filling of the rod and uncrimping of the fibres due to the tension produced in the tow. Also, local displacement and stretching of the tow adjacent to the face of the tongue can occur without the tow slipping on the paper.

To assist in getting the tow through the tongue and reduce the above effects the following arrangement is adopted in FIG. 1. The tongue is provided in two portions, an upstream portion 15A which has a bellmouth 15B, and a downstream portion 15C. Between the downstream end of the upstream portion 15A and the upstream end of the downstream portion 15C there is provided a compression wheel 19 which is driven from the main drive of the machine such that its peripheral speed is equal to the speed of the garniture tape and has a curved-section peripheral groove 19A. The cross-sectional area between the upstream portion 15A of the tongue and the paper web 16 progressively decreases from its upstream end to its downstream end where the tow 18 immediately comes under the control of the wheel 19. The cross-sectional area between the downstream portion 15C of the tongue and the paper web also progressively decreases from its upstream to its downstream end, but the cross-sectional area at its upstream end is slightly greater than the cross-sectional area of the tow where the periphery of the wheel is closest to the paper web 16. The frictional drive imparted to the tow by the wheel 19 assists in getting the tow through the tongue.

FIGS. 2 to 6 inclusive show sections through the tow at various positions along the tongue. After leaving the downstream portion of the tongue 15C the tow passes under a folder 20 where folding of the paper web about the compressed tow commences. As described above, an edge of the paper wrapper is gummed and the edges of the wrapper are sealed together to form the continuous filter rod which is severed into short lengths by the cut-off mechanism.

In FIGS. 7 to 11 inclusive a second embodiment is shown in which like numerals will be used for those parts the same as in the previous embodiment. In this embodiment the downstream portion 15C of the tongue is retained but the upstream portion 15A and 15B is replaced by two wall members 22 and 23 between which runs the periphery of the compression wheel 19. Upstream is a further wheel 21 having a substantially V-shaped channel section as shown in FIG. 8 through which the tow runs. The wheel 21 is free-running. The plates 22 and 23 together with the periphery of the compression wheel 19 also form a V-shaped channel which faces in the opposite direction to the V-shaped channel formed in the periphery of the wheel 21, the two wheels 19 and 21 being disposed so that the tow passes from the wheel 21 to the wheel 19 tangentially and is compressed laterally in the periphery of the wheel 21, and between the periphery of the wheel 19 and the side plates 22 and 23. The cross section of the tow and of the two wheels and side plates are shown in the FIGS. 8 to 11 which illustrate the progressive lateral compression of the tow. Downstream of the compression wheel 19 the apparatus is the same as in FIG. 1 so that the sections shown in FIGS. 4, 5 and 6 apply also to this embodiment. It will be appreciated that the tow is in contact with the periphery of the wheel 19, and is therefore driven thereby, over a greater angle than in the previous embodiment. The apparatus shown in FIG. 7 is again followed by the folding and sealing apparatus and by a cut-off mechanism.

In the embodiment shown in FIGS. 12 to 18 the same numerals are again used for like parts. In this construction the compression wheel, which is shown at 30, has suction applied to it, and the tow is brought into contact with the part of the periphery of the wheel to which suction is applied between the compression wheel and a further smaller suction wheel 34. The wheels 30 and 34 are provided between two plates 32 and 33 as shown in FIGS. 13, 14, and 15. In FIG. 12 the front plate 33 is omitted. The compression wheel 30 consists of a perforated periphery 30A and a single side wall 30B. A suction port 31 shown in ghosted line is provided in the omitted front plate 33 and a blanking plate 30C provided within the wheel 30 allows suction to be applied only to the part of the periphery 30A shown which extends over an angle somewhat greater than a right angle. The construction of the suction wheel 34 is similar, the wheel having a perforated periphery 34A and a single side wall 34B. Suction is applied through a suction port 35 in the omitted front wall 33 shown ghosted in FIG. 12. A blanking plate 36 allows suction to be applied only to a portion of the periphery of the wheel 34. An adjustable perforated plate 50 controls the flow of air to the two suction wheels 30 and 34. This prevents air being drawn back from the direction of the tongue 37 and a shoe 38. The tongue 37 is somewhat similar to the downstream tongue portion 15C of the previous two embodiments but is preceded by the shoe 38. The tongue 37 is followed by the folder 20. The tow 18 is supplied between the wheels 30 and 34 through a straight-sided channel 39 formed between the front and back plates 33 and 32 and a member 40, the position of which is adjustable to alter the depth of the channel 39. The tow is supplied to the channel 39 through a bellmouth or trumpet 41 which tapers in the direction of movement of the tow and produces a certain amount of initial lateral compression. The speed of the tow entering the trumpet is about 1.3 times the peripheral speed of the wheels 30 and 34 which in turn are the same as the speed of the garniture tape and paper web 16 so that a certain amount of longitudinal compression of the tow occurs, so increasing its crimping. The angle between the line of approach of

the tow and the garniture tape is such that the cosine of this angle is substantially equal to the ratio of the speed of the garniture tape to that of the tow approaching the trumpet.

The apparatus shown in FIG. **12** is followed by apparatus for sealing the filter rod and cutting it into short lengths.

FIG. **19** shows a fourth embodiment. In this embodiment the suction wheel **30** of the previous embodiment is replaced by a wheel **52.** A similar wheel **53** is spaced upstream from the wheel **52** and a perforated band **51** passes around the two wheels **52** and **53.** Suction is applied to the lower run of the band **51** by means of a suction chamber **54.** The garniture bed is similar to that shown in the previous embodiment, there being a shoe **38** and a tongue **37.** The tow **18** is applied to the underside of the band **51** through a straight-sided channel **55** similar to the channel **39.** Preceding the channel **55** is a channel **60** which tapers perpendicularly to the plane of the figure in the direction of flow of the tow so that the downstream end has the same cross-section as the channel **55.** The speed of the tow **18** approaching the channel **60** is again approximately 1.3 times the speed of the band **51** which is substantially the same as the speed of the paper web **16** and the garniture tape **13.** A cover plate **56** controls the amount of suction which is applied to the tow in the initial region after it has met the band **51.** Once again the ratio of the speed of the band **51** to the speed of the tow approaching the channel **60** is substantially equal to the cosine of the angle between the tow as it approaches the band **51** and the band. A flap seal **61** is pivoted to the end of the cover plate **56.**

As the tow approaches the band **51** an air flow is drawn longitudinally through the tow and acts to shrink the tow longitudinally, i.e., to increase the crimping. When the tow has reached the band the suction applied to the band controls the tow by holding it firmly against the band, so preserving uniformly along the tow the shrinking already produced. In addition the suction progressively compresses the tow laterally as it approaches the wheel **52** and thus eases the passage of the tow through the tongue by lessening the amount of compression which has to be carried out in the tongue.

The apparatus shown is followed by the rod-sealing apparatus and cut-off mechanism, as before.

In FIG. **20** there is shown a modification to the embodiment of FIG. **19** in which the cover plate **56** is replaced by a suction wheel **57.** The wheel **57** has a perforated periphery **57A** and contains a stationary blanking plate **58** and a stationary baffle **59.** Suction is applied through the centre of the wheel to the angle between the baffle plate **59** and the end of the blanking plate **58** so that suction is applied to the tow over the region where the tow meets the perforated band **51.** To the left of the baffle plate **59** the interior of the suction wheel is open to atmosphere so that air can flow through the periphery of the wheel and across the tow and through the perforated band **51.** Thus, the effect of the suction wheel is to increase the air flow being drawn longitudinally through the tow to assist in increasing the crimping without this increased air flow having to be drawn through the perforated band **51.**

What we claim as our invention and desire to secure by letters Patent is:

1. A continuous cigarette filter rod making machine in which a tow or web of crimped filaments is fed on to a continuous paper wrapper web and is carried through a tongue by means of a garniture tape, the machine comprising a driven compression wheel between which and the paper wrapper the tow is compressed, the compression wheel being provided upstream of at least a downstream part of the tongue, suction being applied to the compression wheel over an angular extent ending in the region of maximum compression between the compression wheel and the paper web, the tow being supplied to the compression wheel adjacent the point at which suction is first applied, and a further suction wheel adjacent the point at which the tow meets the compression wheel to form a channel into which the tow is supplied so that the tow is supplied into the bite formed between the two wheels, the cross-sectional area of the channel decreasing in the direction of travel of the tow so that the tow is progressively compressed, suction being applied to the further suction wheel over the angle for which the tow is in contact with the further wheel.

2. A machine as claimed in claim **1** wherein the peripheral speed of the compression wheel is at least as great as the speed of the garniture tape.

3. A machine as claimed in claim **1** wherein the tow is supplied to the compression wheel through a trumpet, the cross sectional area of which tapers inwards in the direction of travel of the tow.

4. A machine as claimed in claim **1** wherein the two wheels rotate at a peripheral speed substantially equal to the speed of the garniture tape and the tow is supplied at a greater rate so that it concertinas.

5. A machine as claimed in claim **1** wherein the tow is supplied to the band at a greater rate than the speed of the band and is supplied through a trumpet whose cross sectional area tapers in the direction of flow.

6. A machine as claimed in claim **5** wherein the tow is applied to the band at an angle such that the ratio of the speed of the band to the speed of the tow approaching the band is substantially equal to the cosine of the angle at which the tow meets the band.

7. In a continuous cigarette filter rod making machine wherein a tow or web of longitudinally extending crimped filaments is fed onto a continuous paper wrapper web and is carried through a tongue by means of a garniture tape, the improvement comprising:

a first perforated conveyor means upstream of said tongue and spaced from said paper wrapper web for compressing said tow as it passes along a path between said first perforated conveyor means and said paper wrapper web,

b second perforated conveyor means upstream of said tongue and spaced from said first perforated conveyor means for progressively compressing said tow as it passes along said path between both said perforated conveyor means, and

c suction means for drawing air longitudinally through the tow and through both said perforated conveyor means to crimp the tow longitudinally and lessen the compression carried out by the tongue during passage of the tow through the tongue.

8. A machine as claimed in claim **7** wherein each of said perforated conveyor means comprises rollers having a perforated periphery, each said roller including means to limit the passage of air through said perfo-

rated periphery to substantially that portion of the periphery while in contact with the tow.

9. A machine as claimed in claim **8** further comprising means for feeding said tow towards said rollers, said feeding means including channel means extending along the path of said tow upstream from said rollers, the cross-sectional area of said channel means tapering inwards in the direction of travel of the tow.

10. A machine as claimed in claim **9** wherein said channel means includes means for adjusting the cross-sectional area thereof.

11. A machine as claimed in claim **9** wherein said rollers are adapted to rotate at a peripheral speed equal to that of said garniture tape and said means for feeding said tow toward said rollers is adapted to feed said tow at a greater speed whereby said tow concertinas.

12. A machine as claimed in claim **9** wherein said rollers are adapted to feed said tow along the path at an angle with respect to the path of said garniture tape, the cosine of said angle being substantially equal to the ratio of the speed of said garniture tape to the speed of the tow approaching said rollers.

13. In a process for forming a filter rod in which a tow or web of longitudinally extending crimped filaments is fed onto a continuous paper wrapper web and is carried through a tongue by means of a garniture tape, the improvement comprising:

a feeding said tow along a path towards said continuous paper wrapper web, and

b compressing said tow as it moves along said path between the perforated peripheries of a plurality of rollers while simultaneously drawing air through the perforations of the peripheral portion of the rollers in contact with said tow,

c whereby air is drawn longitudinally through the tow to crimp the tow longitudinally and lessen the compression carried out by the tongue during passage of the tow through the tongue.

14. A process as claimed in claim **13** wherein said plurality of rollers rotate at a peripheral speed substantially equal to the speed of said garniture tape and said tow is fed along said path towards said plurality of rollers at a greater speed whereby said tow concertinas.

15. A process as claimed in claim **13** wherein the path along which said tow is fed is at an angle with respect to the path of said garniture tape such that the cosine of said angle is substantially equal to the ratio of the speed of said garniture tape to the speed of the tow approaching said plurality of rollers.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 3,813,996

DATED : June 4, 1974

INVENTOR(S) : Francis A. M. Labbe et al

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the title page, column 1, between lines 11 and 12, insert the following:

-- Assignee: Molins Limited
London, England --

Signed and Sealed this

Twenty-eighth Day of *February 1978*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

LUTRELLE F. PARKER
Acting Commissioner of Patents and Trademarks